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Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

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Citation (APA):
Hjorth, R., Sørensen, S. N., Olsson, M. E., Baun, A., & Hartmann, N. I. B. (2015). *A certain shade of green: New insights into shading effects of nanoparticles on algal growth*. Poster session presented at SETAC Europe 25th Annual Meeting, Barcelona, Spain.

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A certain shade of green: **New insights into shading effects of nanoparticles on algal growth**

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Nanoparticles and shading in ecotoxicology

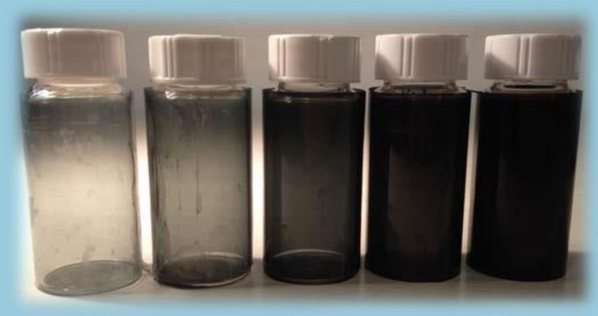
Inhibitory effects of nanoparticles on algal growth have been the subject of many scientific studies. Physical effects – such as shading on a cellular level – is considered a potential effect mechanism (e.g. Hartmann et al., 2012; Schwab et al., 2011; Aruoja et al., 2009).

A change in pigment composition upon nanoparticle exposure has been hypothesized to indicate shading on a cellular level (Wei et al., 2010). Pigment composition is known to be affected by changes in light conditions as a result of photo-acclimation. Here we investigate the pigment composition of green algae and how the composition change as a result of shading.

Method

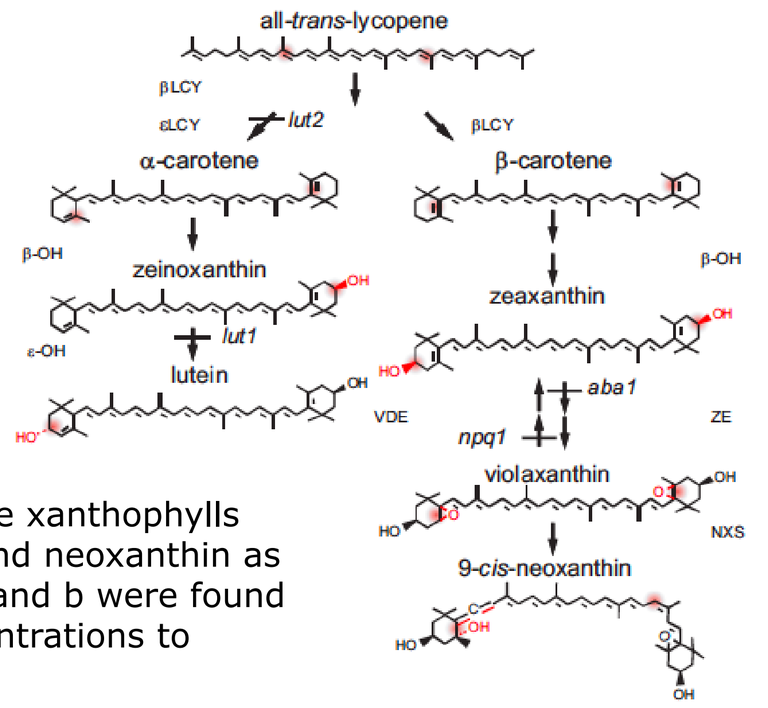
The green microalgae *Pseudokirchneriella subcapitata* was incubated as described in OECD TG 201 using a mini-scale algal test (Arensberg et al., 1995) with different natural density filters on the outside of the vials which only allow for respectively 71, 25, 13 and 6 % light transmission through the glass.

The algae pigments were extracted with acetone and analysed with HPLC-DAD.



Carotenoid biosynthetic pathway

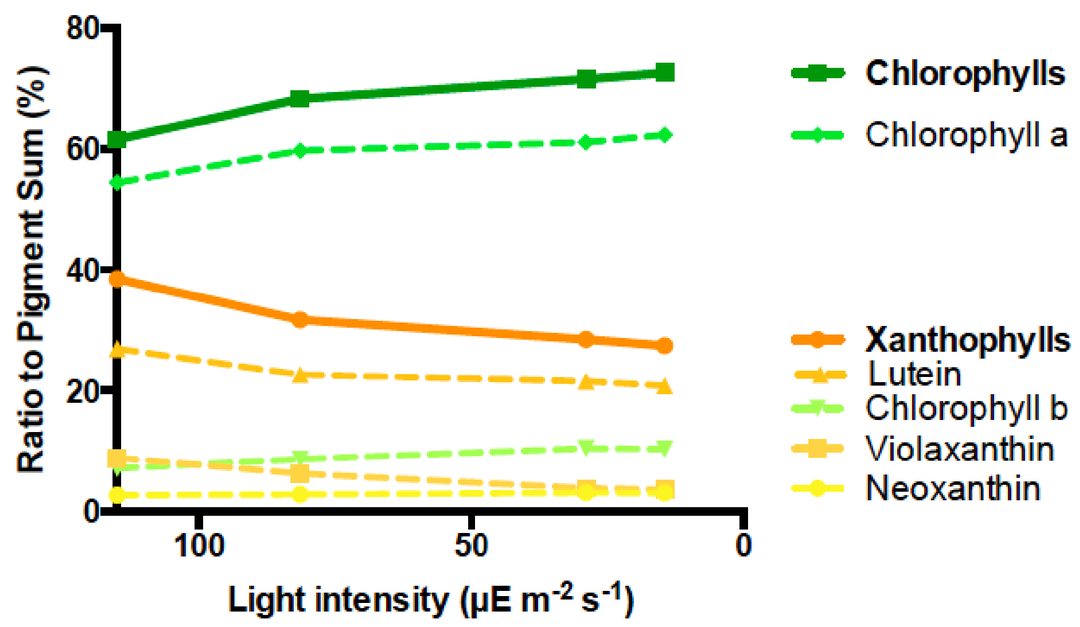
Green algae increase their content of xanthophylls at high light intensities and decease them at lower levels.



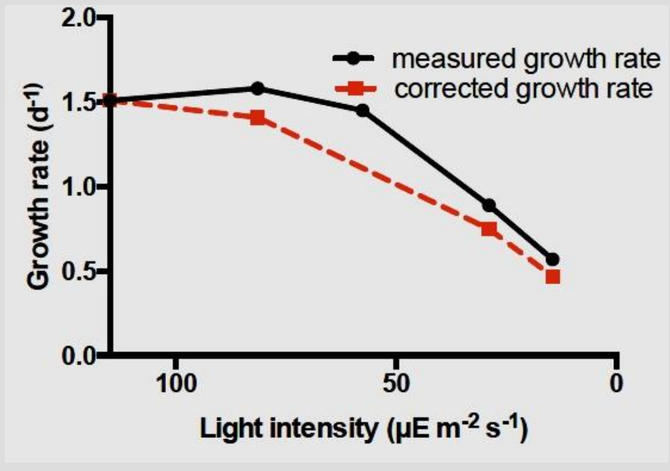
In our extractions, the xanthophylls lutein, violaxanthin and neoxanthin as well as chlorophyll a and b were found in high enough concentrations to quantify.

(Cuttriss et al., 2007)

Changes in pigment composition due to shading



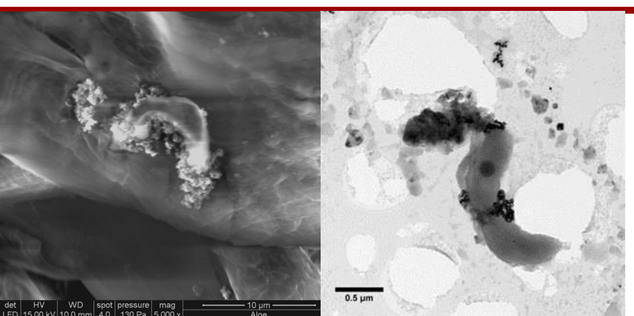
Corrected growth rate



Normal growth rate calculations are often based on chlorophyll concentrations (e.g. fluorescence measurements). However, a relative increase in chlorophyll can be caused by shading. A corrected growth rate can be estimated if the change in pigment composition due to shading is known.

Conclusion

- It was confirmed that pigment ratios in green algae *P. subcapitata* are correlated to light intensity and thereby affected by shading.
- Using this method we will test suspensions of nanoparticles suspected to affect algae growth through shading.
- This method will assist to elucidate the effect mechanisms of nanoparticles and other turbid solutions towards algae.



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